

March 4, 2005

TO: Wisconsin Potential Study Advisory Committee and stakeholders

FROM: Scott Pigg, ECW

RE: Advance materials for March 8 stakeholder meeting

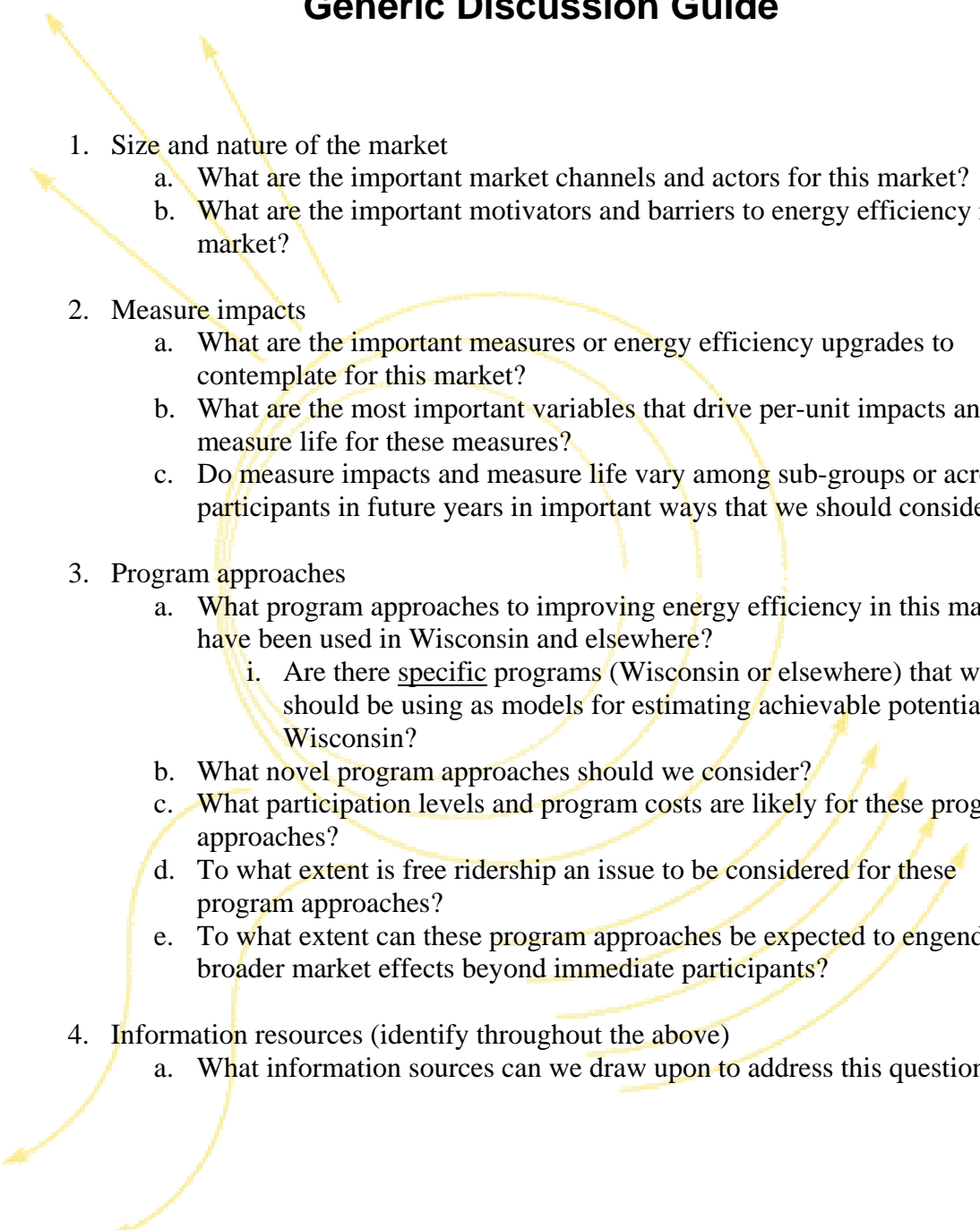
Below are advance materials for the March 8, 2005 Potential Study Stakeholder meeting covering the following four markets:

1. (9:00-10:30 am) Market 24 — **New Home Construction**
2. (11:00-12:30 pm) Market 25 — **Homeowner Remodeling**
3. (1:00-2:30 pm) Market 28 — **Homeowner Building Shell Improvements**
4. (3:00-4:30 pm) Market 23 — **Homeowner Water Heater Replacement**

(If you are planning to attend this meeting, and have not already done so, please RSVP to [sbenzmiller@ecw.org](mailto:sbenzmiller@ecw.org). Lunch will be provided for those who will be present between 12:30 and 1:00)

A generic discussion guide follows, along with some facts about the markets to be discussed and some issues I have identified. These are simply meant to get the discussion going; they're not intended to limit the scope of the discussion.

# Generic Discussion Guide

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1. Size and nature of the market
    - a. What are the important market channels and actors for this market?
    - b. What are the important motivators and barriers to energy efficiency in this market?
  2. Measure impacts
    - a. What are the important measures or energy efficiency upgrades to contemplate for this market?
    - b. What are the most important variables that drive per-unit impacts and measure life for these measures?
    - c. Do measure impacts and measure life vary among sub-groups or across participants in future years in important ways that we should consider?
  3. Program approaches
    - a. What program approaches to improving energy efficiency in this market have been used in Wisconsin and elsewhere?
      - i. Are there specific programs (Wisconsin or elsewhere) that we should be using as models for estimating achievable potential for Wisconsin?
    - b. What novel program approaches should we consider?
    - c. What participation levels and program costs are likely for these program approaches?
    - d. To what extent is free ridership an issue to be considered for these program approaches?
    - e. To what extent can these program approaches be expected to engender broader market effects beyond immediate participants?
  4. Information resources (identify throughout the above)
    - a. What information sources can we draw upon to address this question?

# New Home Construction

## ***Current scope***

“This market embraces the construction of single-family, owner-occupied housing. Potential estimates will be based on program options to encourage more efficient building shells, higher efficiency mechanical systems, efficiency upgrades to appliances, and efficiency upgrades for hard-wired lighting.”

## ***Some relevant facts***

- 25,000 to 30,000 new homes are typically constructed in Wisconsin each year (Table 1).
- Though detailed statistics are difficult to come by, compared to some other states, Wisconsin appears to have relatively more homes built by small-volume builders and fewer homes built by large production builders.
- In the most recent Focus on Energy program year, about 250 builders completed about 1,500 homes that were certified under the Wisconsin Energy Star Homes program (Table 2). About half of the builders certify only one home in a given year.
- The program currently provides a subsidy of up to \$360 toward defraying the cost of certification by independent consultants under the program, who set their own fees. The consultant fees typically range between about \$650 and \$1,000.
- An Energy Center study of differences gas and electricity use in new Wisconsin homes suggested that the Wisconsin Energy Star Homes program use about 100 therms less natural gas than comparable non-program homes. The study showed no statistically significant difference in electricity use at that time.
- Both the above study and the Energy Center Residential Characterization Study suggest that the average new home in Wisconsin uses about 1,000 therms of gas—750 to 800 therms of which is used for space heating—and 10,000 kWh of electricity annually.
- There are changes to the federal Energy Star standards for a new home that could affect the Wisconsin program and potential impacts from the program (see Table 3).

TABLE 1, WISCONSIN NEW HOME STARTS.

Annual Adjusted Housing Starts in WI*			
Year	1-2 Family	3-4 Family	5+ Family
1997	21,835	316	625
1998	24,809	316	658
1999	25,994	339	542
2000	25,186	362	509
2001	26,469	360	617
2002	27,178	302	580
2003	30,333	326	499
2004	Will be available in April 2005		

\* Source: Wisconsin Builders Association Reports

TABLE 2, WISCONSIN ENERGY STAR HOMES PROGRAM ACTIVITY.

Program Year	# of WESH Homes	# of WESH Builders
Pre-2001	321	99
2001-02	678	159
2002-03	824	177
2003-04	1,490	248
Overall	3,313	345

TABLE 3, PROPOSED CHANGES TO FEDERAL ENERGY STAR HOME STANDARDS

<b>Envelope</b>	<b>0.35 air changes per hour; 2004 IECC compliant insulation Thermal bypass checklist</b>
<b>Ducts</b>	<b>Leakage &lt;4 cfm/100 ft<sup>2</sup></b>
<b>Water heater</b>	<b>0.60 EF (gas) 0.92 EF (electric)</b>
<b>HVAC</b>	<b>90 AFUE</b>
<b>Windows</b>	<b>Climate-specific; U-value &lt; 2001 IECC; SHGC &lt; 0.4</b>
<b>Appliances</b>	<b>A total of five Energy Star qualified from the following: light fixtures, ceiling fans, appliances</b>
<b>Source: ICF consulting</b>	

## ***Discussion Issues***

- In prior stakeholder meetings it has been suggested that appliances and mechanical systems associated with new construction should be lumped in with other purchase markets being considered, and that the new construction market analysis here should focus on shell—and possibly lighting—opportunities.
- Are there “spillover” effects that should be considered in the analysis? In other words, to what extent do builders outside the program—or builders who no longer participate—use the specifications and techniques promulgated by the program in homes that are not certified under Wisconsin Energy Star Homes?
- Are there program models that would reduce the program cost by through sampling or reduced testing? What effect might these have on participation and average energy savings?
- What are the implications of the proposed changes to the federal requirements for Energy Star Homes?
- What is the potential for making inroads into the installation of more efficient lighting fixtures in new homes?

# Home Remodeling

## ***Current scope***

“This market involves homeowners undertaking remodeling projects with energy-related aspects. Potential estimates will be based on program options to encourage shell improvements, insulation additions, window replacement, and air sealing during remodeling as well as efficiency upgrades for appliances and lighting purchased for remodeling projects. Does not include mechanical system replacements, as these are covered in other markets.”

## ***Some relevant facts***

The following derive from a telephone survey of home remodeling conducted by the Energy Center for Focus on Energy in 2002:

- About 8-9 percent of single-family owner-occupied households remodel in a given year. Over a ten-year period, about 70 percent of households undertake at least one remodeling project costing \$5,000 or more.
- Overall, energy efficiency ranks below improving comfort, appearance and home value as a motivator (Figure 2). However, improving energy efficiency is a major motivator for about a quarter of remodeling projects; these projects are much more likely to involve windows and insulation. It is not at all a motivator for another quarter of projects (Figure 3), which are more likely to involve garages, decks and bathrooms.
- Nearly half of remodeling projects involve new windows; half of survey respondents who installed new windows expected a reasonable payback from energy savings.
- Overall, contractors are used for a little more than half of remodeling projects. They are least likely to be used for basement remodels and decks; they are most likely to be used when siding or mechanical system replacement is involved.

Facts related to Focus on Energy program efforts to improve energy efficiency in existing homes:

- Focus on Energy works with about 125 contractors and other market providers under “Home Performance with Energy Star” to encourage energy efficiency associated with remodeling (Table 4).

- In the most recent program year about 1,600 ratings or assessments were conducted; about 60 percent of these resulted in a rebate for at least one shell measure (Table 5). Remodeling contractors accounted for about 7 percent of this activity (Table 6).
- Air sealing, attic insulation and sidewall insulation lead the list of shell measures rewarded under the program (Table 7). Current rebates for measures range from \$75 to \$150 (Table 8).

FIGURE 1, REMODELING ACTIVITIES UNDERTAKEN (UPPROMPTED AND PROMPTED RESPONSES).

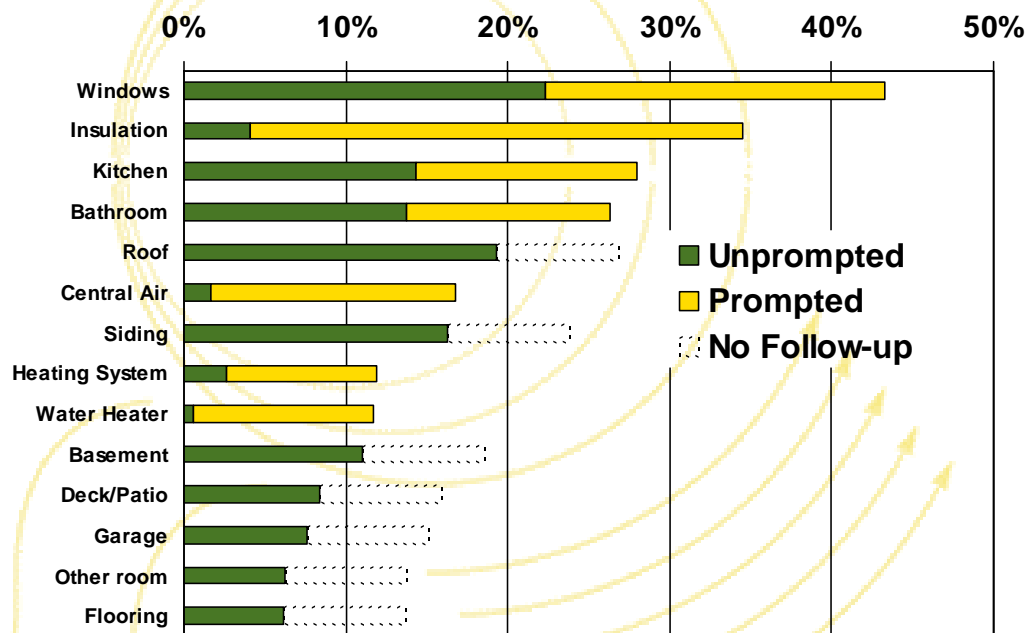


FIGURE 2, MOTIVATORS FOR REMODELING

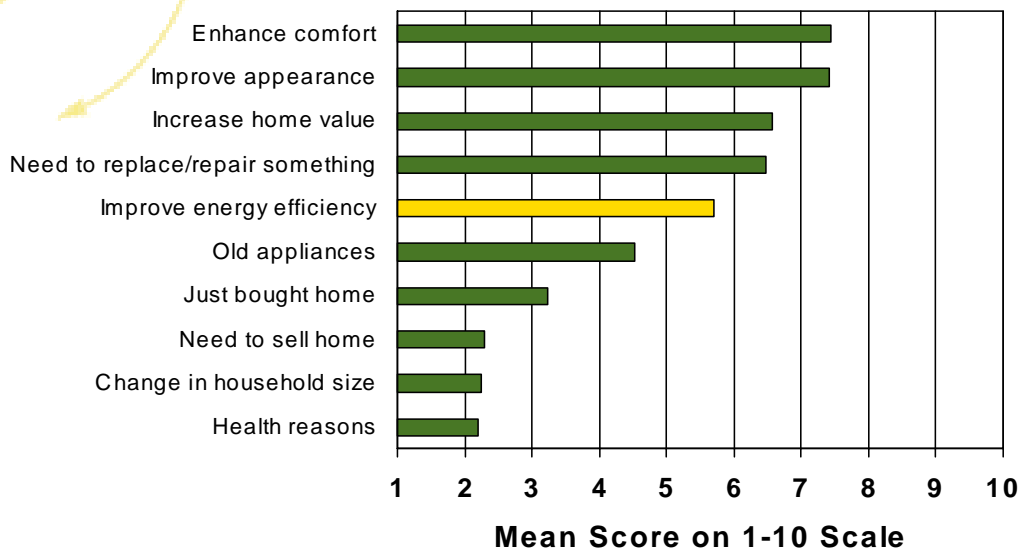


FIGURE 3, DISTRIBUTION OF IMPORTANCE OF ENERGY EFFICIENCY IN DECISION TO UNDERTAKE REMODELING

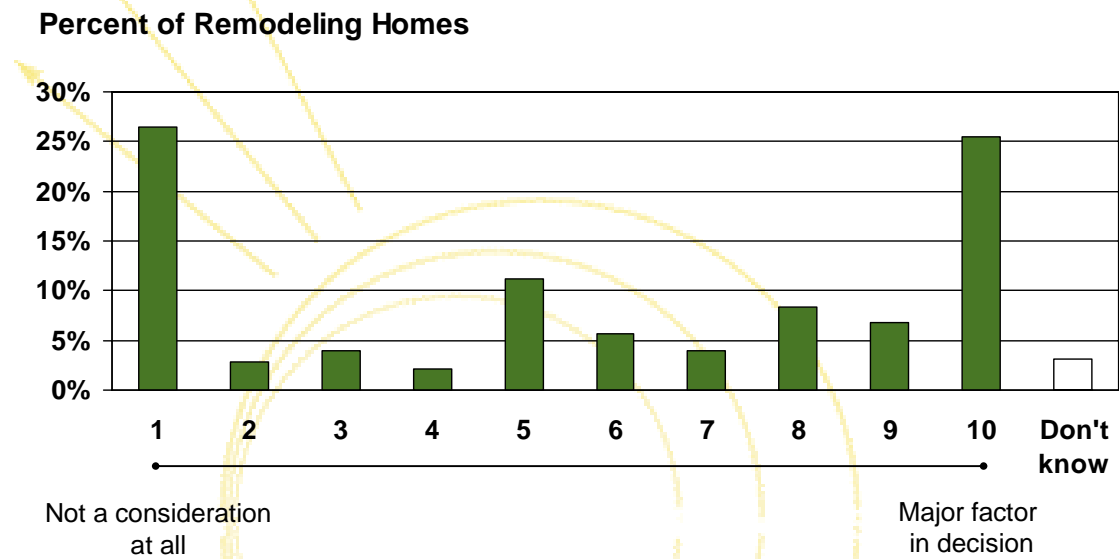


TABLE 4, TRENDS IN MARKET PROVIDERS FOR HPWES.

Home Performance with Energy Star Program Providers			
Type of Provider	Program Year		
	2001-02	2002-03	2003-04
Consultants	20	32	36
Qualified Contractors	11	15	16
Ally - Heating	6	17	21
Ally - Insulation	4	6	17
Ally - Other	0	0	5
Remodeler	1	9	29
Total	42	79	124

TABLE 5, TRENDS IN OVERALL ASSESSMENTS AND REWARDS FOR HPWES.

Program Year	# of Assessments / Ratings	Assessments / Ratings Resulting in at Least One Rebated Shell Measure Installed (All Market Providers)	
		#	%
2001-02	225	109	48%
2002-03	721	413	57%
2003-04	1,608	956	59%
Overall	2,554	1,478	58%

TABLE 6, TRENDS IN ASSESSMENTS AND REWARDS FOR REMODELING CONTRACTORS.

Program Year	# of Assessments / Ratings Resulting in at Least One Rebated Shell Measure Installed		
	All Market Providers	Remodelers Only	
		#	%
2001-02	109	1	1%
2002-03	413	19	5%
2003-04	956	64	7%
Overall	1,478	84	6%

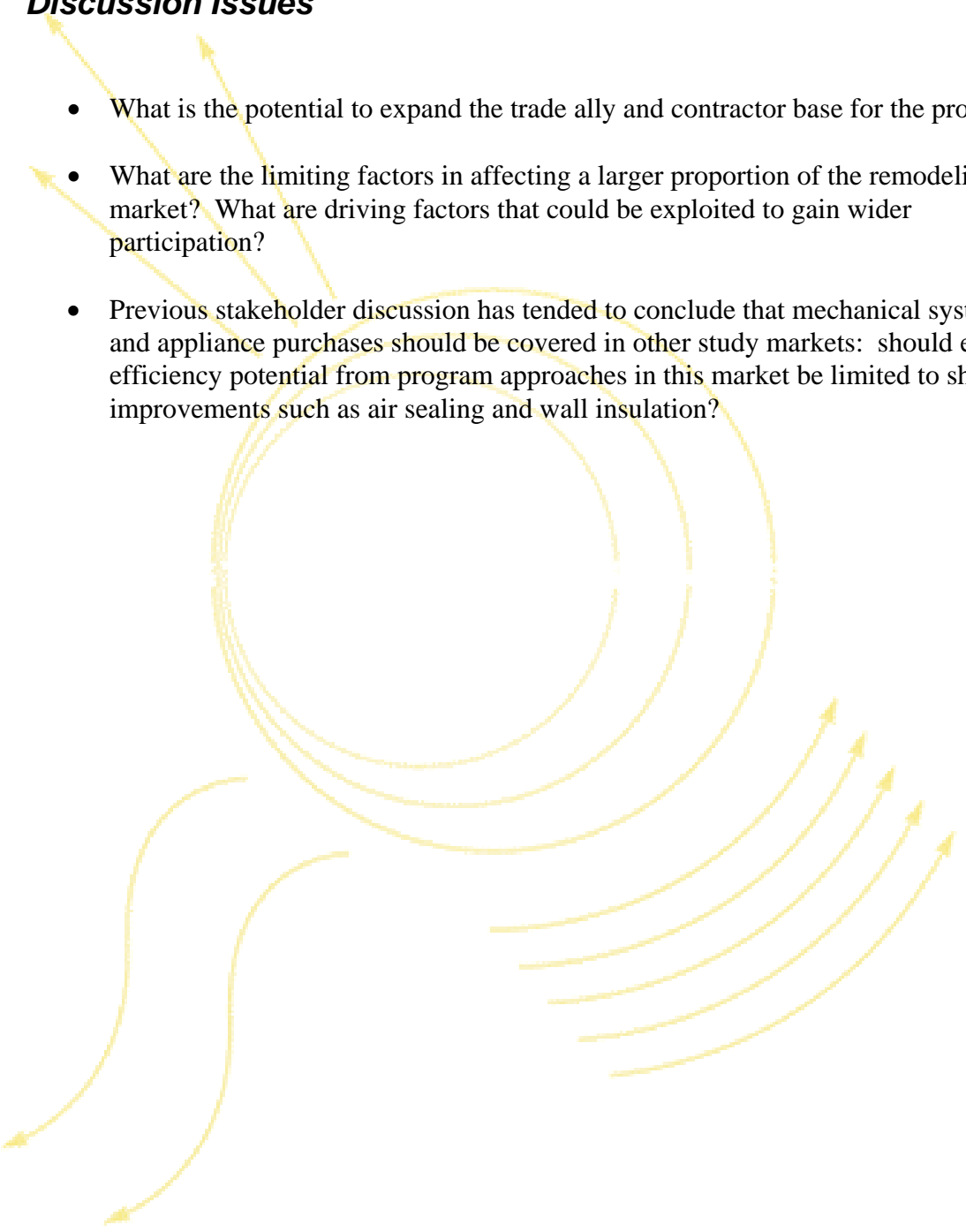
TABLE 7, TRENDS IN MEASURES INSTALLED UNDER HPWES.

Home Performance with Energy Star Shell Measures Installed				
Measure	Program Year			
	2001-02	2002-03	2003-04	Overall
Air Sealing (Per 100 CFM)	200	553	1,350	2,103
Attic Insulation	167	365	754	1,286
Exterior Foundation Insulation	9	19	40	68
Floor Insulation	4	50	97	151
Foam Sidewall (AGW) Insulation 1"	0	3	27	30
Foam Sidewall (AGW) Insulation 1/2"	0	8	31	39
Interior Foundation Insulation	0	39	83	122
Sidewall Insulation	62	211	395	668
Sill Box Insulation	25	164	321	510

TABLE 8, CURRENT REWARD AMOUNTS UNDER HPWES.

Home Performance with Energy Star Rewards	
Measure	Amount
Rating / Assessment	\$75
Air Sealing	\$75
Attic Insulation	\$100
Exterior Foundation Insulation	\$100
Floor Insulation	\$75
Foam Sidewall (AGW) Insulation 1"	\$150
Foam Sidewall (AGW) Insulation 1/2"	\$100
Interior Foundation Insulation	\$75
Sidewall Insulation	\$150
Sill Box Insulation	\$0

## ***Discussion Issues***

- What is the potential to expand the trade ally and contractor base for the program?
  - What are the limiting factors in affecting a larger proportion of the remodeling market? What are driving factors that could be exploited to gain wider participation?
  - Previous stakeholder discussion has tended to conclude that mechanical system and appliance purchases should be covered in other study markets: should energy efficiency potential from program approaches in this market be limited to shell improvements such as air sealing and wall insulation?
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# Homeowner Building Shell Improvements

## Current Scope

“This market considers program approaches to encourage homeowners to undertake building shell improvements for space heating and cooling savings. It does not cover improvements undertaken as part of home remodeling, which are considered separately in Market #25.”

## Some relevant facts

From the Center’s 1999 Residential Characterization Study:

- Nearly half of Wisconsin homes have a shell improvement opportunity that could pay back in ten years or less (Table 9).
- The older the home, the more likely it is to be inadequately insulated or excessively leaky (Figure 4). High air leakage is correlated with reported comfort problems.
- More than half of homeowners whose homes were judged to be inadequately insulated based on on-site audits believed that their home was adequately or well insulated (Figure 5).
- Homeowners are more likely to identify leaky windows and doors as the most effective energy saving opportunity in their homes than they are to point to inadequate insulation or air leakage.

TABLE 9, SHELL MEASURE OPPORTUNITIES IN WISCONSIN HOMES (10-YEAR PAYBACK OR LESS)

Measure	Percent of homes w/ opportunity	Average annual savings <sup>a</sup>	Average installation cost
Wall insulation	14%	\$147	\$1,097
Ceiling insulation	21%	\$82	\$403
Floor insulation	3%	\$163	\$446
Rimjoist insulation	21%	\$10	\$68
Infiltration reduction	19%	\$94	\$278
Any of the above	45%		

<sup>a</sup>Based on avg. 1999 gas price of 54 cents/therm and avg. electricity rate of 6.5 cents/kWh

FIGURE 4, SHELL OPPORTUNITIES VERSUS DECADE OF CONSTRUCTION.

**Percent of Wisconsin Homes with Opportunities for...**

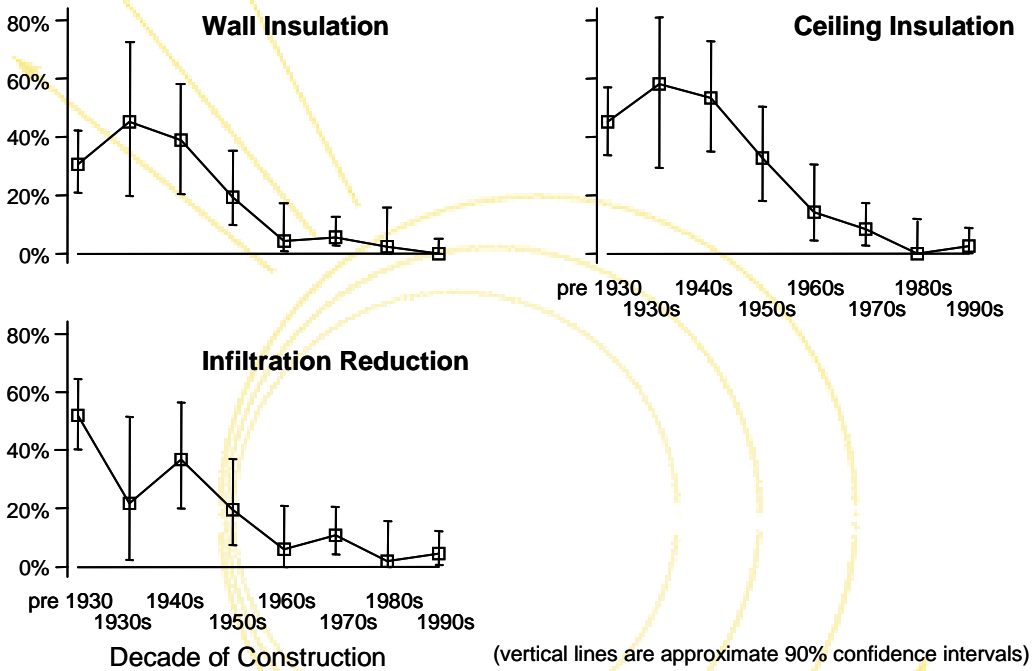
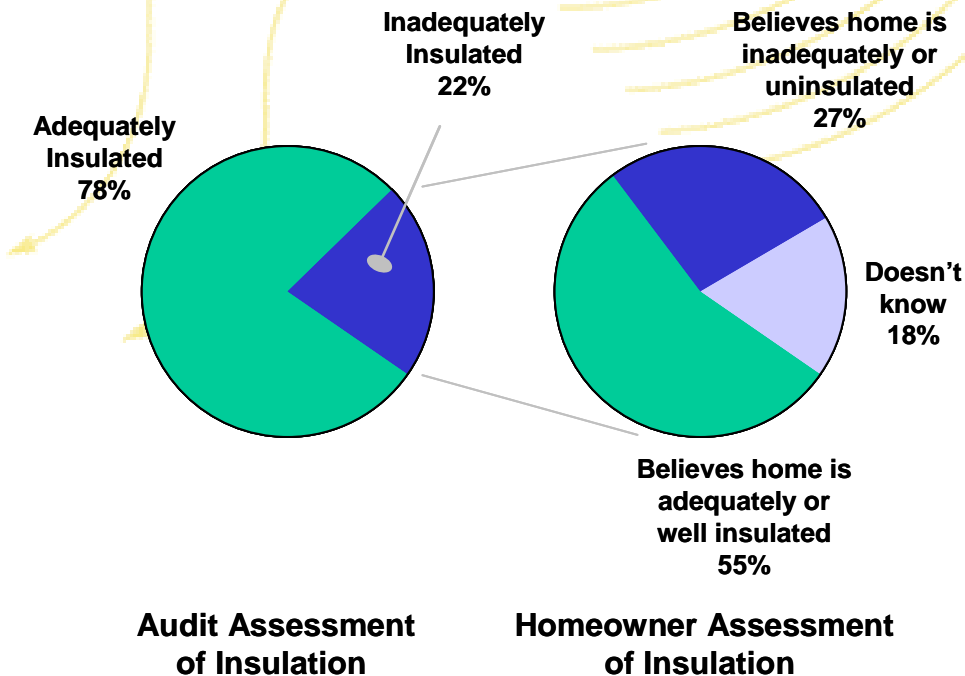
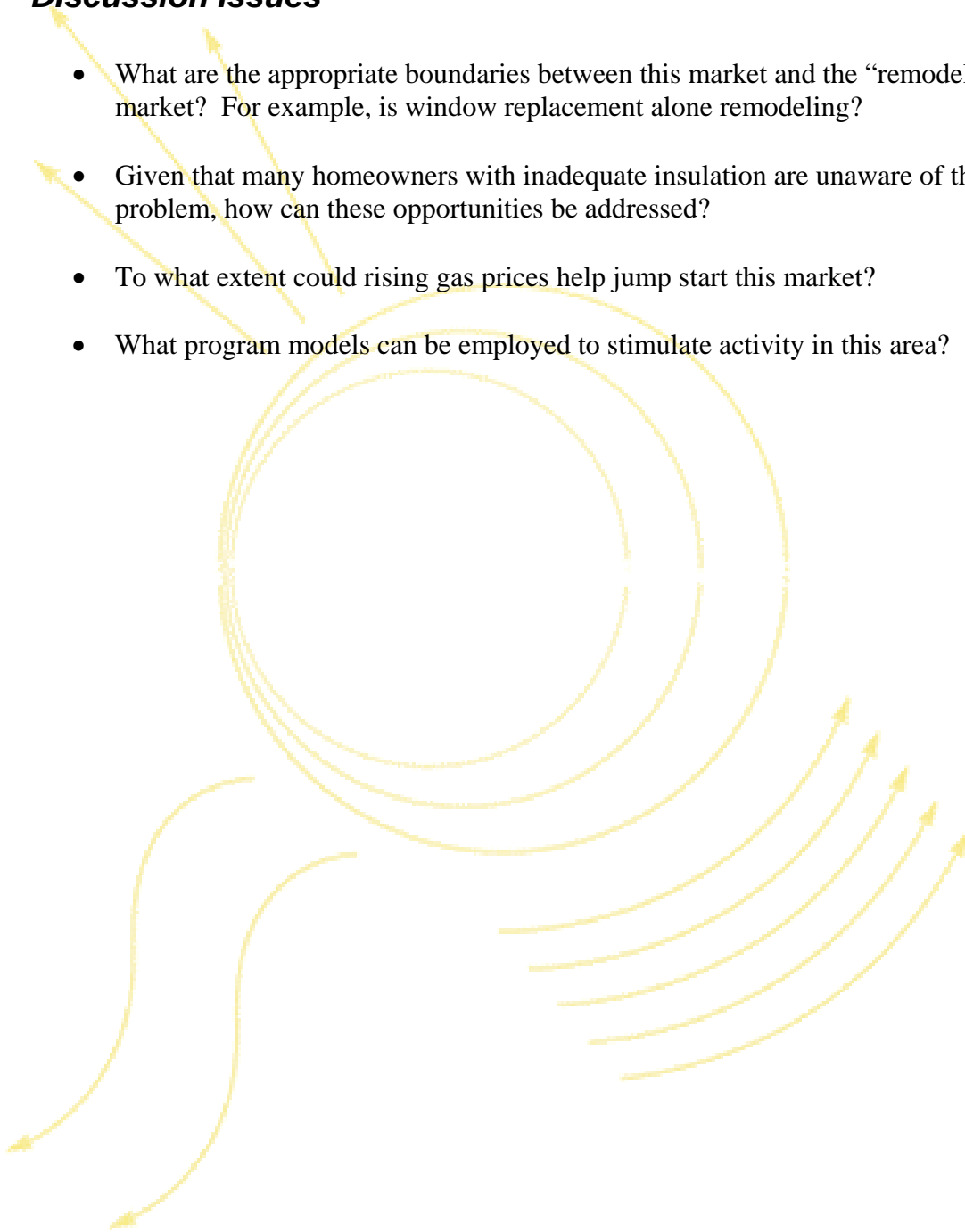


FIGURE 5, AUDIT AND HOMEOWNER PERCEPTION OF INSULATION LEVELS.



## ***Discussion Issues***

- What are the appropriate boundaries between this market and the “remodeling” market? For example, is window replacement alone remodeling?
- Given that many homeowners with inadequate insulation are unaware of the problem, how can these opportunities be addressed?
- To what extent could rising gas prices help jump start this market?
- What program models can be employed to stimulate activity in this area?



# Homeowner Water Heater Purchase

## ***Current Scope***

“This market is defined as homeowners who are in the market to replace an existing water heater. Potential estimates will be based on program options to encourage upgrades in the energy factor of the replacement unit, switching from electric to gas, switching from atmospherically vented to power-vented units, and the installation of on-demand units. Does not include systems purchased for new homes.”

## ***Some relevant facts***

- Data from the Center’s 1999 Residential Characterization Study indicated that 62 percent of homeowners have a natural gas water heater, 28 percent have an electric water heater, and 9 percent have a propane water heater.
- The average Energy Factor (EF) of an existing fuel-fired water heater is 0.55. (source: Residential Characterization Study).
- About 16 percent of households have an electric water heater but also have natural gas or propane service for other end uses (source: Residential Characterization Study).
- Seven to eight percent of single-family homeowners purchase a water heater each year. About 20 percent of these are for new homes. (source: 2001 and 2003 Appliance Sales Tracking Surveys)
- About a third of purchasers report installing the new water heater themselves (source: 2001 Appliance Sales Tracking Survey).
- About half of purchasers of replacement water heaters report that they needed to replace the old water heater right away—with 48 hours (source: 2001 Appliance Sales Tracking Survey).
- 80 percent of purchasers of new water heaters report that their new unit is a high efficiency unit; nearly all of the remainder are unsure (source: 2001 Appliance Sales Tracking Survey).
- In January 2004, the federal standard for minimum EF of a 40-gallon gas water heater increased from 0.544 to 0.594. The highest efficiency gas water heater

models available have EFs of 0.64 to 0.65. A family of four using about 56 gallons of hot water a day will save about \$16 per year by upgrading from the federal standard minimum EF to the highest available (@ 90 cents/therm).

- The federal standard for minimum EF of a 40-gallon electric water heater increased from 0.877 to 0.917. The highest efficiency electric water heater models available have EFs of 0.94 to 0.95. A family of four using about 56 gallons of hot water a day will save about \$19 per year by upgrading from the federal standard minimum EF to the highest available (@ 10 cents/kWh).
- WECC estimates 97 therms of space heating energy savings associated with “closing the hole” by replacing an atmospherically vented water heater with a power-vented model.
- Analysis by the Energy Center for the Low-Income Weatherization program suggests that the savings from upgrading to a gas tankless water heater are worth about \$60 per year (@ 90 cents per therm, for a family of four using about 56 gallons of hot water a day). The average installed cost of a tankless unit in a pilot program under the Weatherization program was about \$2,000, compared to an estimated \$850 for a conventional gas water heater.
- The above pilot program examining tankless water heaters turned up some evidence on installation problems (e.g. units that ruptured due to improper exterior venting) and occupant issues (e.g. units that occasionally did not fire when there was a call for hot water).

## ***Discussion Issues***

- Are there any programmatic opportunities for promoting higher efficiency water heaters given: (a) the small incremental savings between the federal standards and the highest efficiency levels; and, (b) that many water heater purchases are in essence emergency replacements?
- Is there a programmatic model that could successfully stimulate fuel switching from electric to fuel-fired water heaters?
- What is the potential for encouraging tankless water heaters in Wisconsin?

